Sex differences in outcomes of total hip arthroplasty for the treatment of ankylosing spondylitis

Liang Zhang[1], Hong-Chao Li[2], Si-Liang Man[2], Tao Bian[1], Yong Dou[1], Wei Liu[2], Yi-Xin Zhou[1]

[1]Department of Adult Joint Reconstructive Surgery, Beijing Jishuitan Hospital, Fourth Clinical College of Peking University, Jishuitan Orthopaedic College of Tsinghua University, Beijing 100035, China;
[2]Department of Rheumatology, Beijing Jishuitan Hospital, Fourth Clinical College of Peking University, Jishuitan Orthopaedic College of Tsinghua University, Beijing 100035, China.

To the Editor: Ankylosing spondylitis (AS) has always been viewed as a male-dominated disease with previous studies showing a male–female ratio of approximately 3:1. However, more recent surveys have shown increasing homogeneity in gender prevalence.[1] Female patients with AS tend to have a longer diagnosis delay compared with male patients. AS patients with delayed diagnosis displayed worse outcomes in disease activity, function, spinal mobility, and radiographic damage.[2,3]

As being a common disease manifestation of AS and accounting for about one-fourth to one-third of the AS patients, hip involvement reduces their physical status, employability, and psychosocial status directly, and consequently increases the burden of AS and impacts its prognosis negatively. Unlike new bone formation in the axial spine, synovial inflammation within the hip joint causes bone erosion and joint space narrowing. Total hip arthroplasty (THA) is a reliable treatment option for AS patients with end-stage hip involvement. A series of literature has discussed the outcomes of THA reconstruction performed on this patient population.

To our knowledge, there is no previous research that has discussed the impact of gender on baseline patient demographics, clinical and laboratory parameters, and outcomes of THA on AS patients, and therefore we conducted a retrospective analysis of 86 female patients with AS. The objectives of this study were to determine: (1) whether there were significant differences between female and male AS patients on baseline patient demographics, clinical, and laboratory characteristics and (2) whether gender affected outcomes following THA on AS patients significantly.

This was a cross-sectional retrospective controlled study that conformed to the New York criteria for the diagnosis of AS on 86 consecutive female inpatients (121 hips) who received THAs between 2006 and 2019 and were recruited into our study. We also reviewed 468 consecutive male patients (663 hips) as a control group, who received THAs between 2006 and 2019. The study was approved by the Institutional Research Ethics Committee of Beijing Jishuitan Hospital (No. 202004-83). Each participant had been informed about the purpose of this study before signing the written informed consent.

The collected data included patient demographics and disease characteristics [Table 1]. Age at disease onset was defined as the date of the first appearance of AS-related symptoms. Extra-articular manifestations were defined as the current or ever uveitis, and/or current or ever psoriasis, and/or current or ever inflammatory bowel diseases. The information about smoking habits (current or past) was also collected.

The total passive range of motion (the sum of flexion, extension, abduction, adduction, internal rotation, and external rotation), the degree of hip flexion, and the degree of hip flexion contracture were documented before operation from chart review. The pre-operative levels of erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), hemoglobin, and albumin were obtained routinely from the chart review.

Every patient received a clinical examination routinely before the surgery, outpatient examinations 3, 6, and 12 months after the surgery, and examinations thereafter biannually. Disease activity was evaluated by the Bath ankylosing spondylitis disease activity index (BASDAI), and functional status was evaluated by the Bath ankylosing spondylitis functional index (BASFI). The clinician-reported outcomes (CROs), namely Harris hip score

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Correspondence to: Prof. Yi-Xin Zhou, Department of Adult Joint Reconstructive Surgery, Beijing Jishuitan Hospital, Fourth Clinical College of Peking University, Jishuitan Orthopaedic College of Tsinghua University, 31 East Xinjiekou Street, Beijing 100035, China
E-Mail: orthoyixin@yahoo.com

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Table 1: The baseline patient demographics, clinical, and laboratory parameters of AS patients with end-stage hip involvement.

Parameters	Total AS patients ($n = 784$ hips)	Female group ($n = 121$ hips)	Male group ($n = 663$ hips)	*P* values
BMI (kg/m^2)	22.8 (19.7–25.6)	23.3 (21.3–25.3)	22.5 (19.4–25.7)	0.147
Left side, *n* (%)	409 (52.2)	63 (52.1)	346 (52.2)	0.980
Bilateral surgery, *n* (%)	463 (59.1)	71 (58.7)	392 (59.1)	0.927
Age at onset (years)	22 (17–26)	23 (18–30)	21 (16–25)	0.001
Age at THA (years)	38 (29–49)	43 (32–55)	37 (29–48)	0.002
Disease duration (years)	16 (10–23)	18 (10–27)	15 (10–23)	0.081
Diagnosis delay (years)	6 (2–14)	7 (2–15)	6 (3–13)	0.217
EAMs				
Uveitis, *n* (%)	65 (8.3)	24 (19.8)	41 (6.2)	<0.001
IBD, *n* (%)	42 (5.4)	3 (2.5)	39 (5.9)	0.126
Smoking habits, *n* (%)	224 (28.6)	6 (5.0)	218 (32.9)	<0.001
Preoperative flexion contracture (°)	20 (10–30)	15 (0–30)	20 (10–30)	0.013
Preoperative ROM (°)	55 (0–125)	65 (0–130)	50 (0–120)	0.423
Preoperative hip flexion (°)	30 (0–80)	30 (0–80)	30 (0–75)	0.452
Bony ankylosis, *n* (%)	250 (31.9)	39 (32.2)	211 (31.8)	0.921
ESR (mm)	22 (11–40)	19 (11–41)	22 (11–40)	0.713
CRP (mg/L)	13.3 (5.6–29.0)	8.1 (3.4–18.2)	14.9 (6.2–30.5)	<0.001
HGB (g/L)	134 (118–147)	120 (112–132)	137 (121–148)	<0.001
ALB (mg/L)	42.7 (39.6–45.9)	42.4 (39.3–45.1)	42.8 (39.7–46.0)	0.486
BASDAI	4.0 (3.0–5.3)	3.6 (3.1–5.0)	4.0 (3.0–5.4)	0.141
BASFI	56 (45–70)	46 (42–62)	56 (45–70)	<0.001
SF-12 MCS	43.0 (38.8–47.5)	43.0 (38.9–47.4)	43.0 (38.7–47.6)	0.889
SF-12 PCS	35.4 (28.4–38.8)	36.6 (30.4–40.0)	34.8 (28.2–38.8)	0.058
HHS	36 (26–44)	38 (28–46)	36 (25–44)	0.056

The value of continuous variables was presented as median and quartile (25%–75%) and the categorical variables were presented as number plus percentage. ALB: Albumin; AS: Ankylosing spondylitis, BASDAI: Bath ankylosing spondylitis disease activity index; BASFI: Bath ankylosing spondylitis functional index; BMI: Body mass index; CRP: C reactive protein; EAMs: Extra-articular manifestations; ESR: Erythrocyte sedimentation rate; HGB: Hemoglobin; HHS: Harris hip score; IBD: Inflammatory bowel disease; ROM: Range of motion; SD: Standard deviation; SF-12 MCS: Short form-12 mental component summary; SF-12 PCS: Short form-12 physical component summary; THA: Total hip arthroplasty.

(HHS), were evaluated by orthopedic surgeons directly at the time of consultation. Patient-reported outcomes (PROs), including the 12-Item Short Form Health Survey (SF-12) and patients' satisfaction, were conducted by two independent observers who had not participated in the THAs. Patients' satisfaction was rated using a self-administered system with four scales (very satisfied, somewhat satisfied, somewhat dissatisfied, and very dissatisfied).

Statistical analysis was performed using SPSS software for Windows (version 25.0, IBM Corp, Armonk, NY, USA). Descriptive analysis of categorical variables was presented in the form of percentages and frequencies, and descriptive analysis of continuous variables was shown as mean and standard deviation or median and quartile (25%–75%) if the data were skewed. The pre-operative and final follow-up clinical parameters were compared using the Wilcoxon signed-rank test. Independent sample Student *t* tests or Mann-Whitney tests for continuous variables and χ^2 tests for dichotomous variables were used respectively to compare and identify the intergroup differences. Statistical significance was defined as $P < 0.05$.

The baseline patient demographics, clinical, and laboratory parameters were summarized and are presented in Table 1. There were 56 female patients (82 hips) with an average follow-up duration of 117.5 months (interquartile range [IQR], 58–139 months). And there were 9 patients (11 hips) who had follow-up duration <24 months and 21 patients (28 hips) who were lost to be monitored. For male patients, the mean duration of follow-up of 300 patients (444 hips) was 100.2 months (IQR, 60–133 months). Seventy-two patients (86 hips) had follow-up duration <24 months and 96 patients (133 hips) were lost to be monitored.

Significant differences were shown between pre-operative and post-operative clinical parameters, including HHS, short form-12 physical component summary (SF-12 PCS), short form-12 mental component summary (SF-12 MCS), BASDAI, and BASFI, in female patients at the latest follow-up visit. The mean HHS increased from 39 (27–46) before surgery to 88 (81–96) at the latest follow-up visit ($P < 0.001$). The patients' satisfaction was very satisfied in 43 hips, somewhat satisfied in 19 hips, somewhat dissatisfied in 16 hips, and very dissatisfied in four hips. However, post-operatively there was no significant difference in these clinical parameters between the female group and the male group [Supplementary Table 1, http://links.lww.com/CM9/A780].

This study is the largest series of reporting the characteristics of baseline patient demographics, clinical, and

laboratory parameters of female AS patients with end-stage hip involvement so far. We failed to find out the trend of a longer diagnosis delay on female AS patients as discussed in previous studies,[1] although the hips of female patients had a significantly older age of disease onset and of THA in our series. And here are our explanations. Previous literature has stated the differences in clinical symptoms reported by female patients, including a lower frequency of typical inflammatory back pain, more prominent upper thoracic and neck, or widespread pain accompanied by less severe or slower progression of radiographic injury.[1] In contrast, the study focused on female inpatients with end-stage hip involvement, which has been fully documented that hip arthritis is closely associated with more severe spinal involvement and a higher disease burden. Therefore, female patients are more likely to be diagnosed with AS when the clinical and radiographic evidence are detectable.

One thing to be noted in terms of baseline parameters is that the hips of female patients had a significantly lower BASFI compared with the hips of male patients. On the contrary, it was generally recognized that female AS patients showed a higher disease burden concerning disease activity and pain scores, including BASDAI, BASFI, and quality of life. Besides, studies on the gender difference in CRP showed significantly higher baseline levels of male patients compared with the females, and data of ESR level were inconclusive to identify sex differences.[1] Our results of CRP and ESR were consistent with them.

THAs have been applied to treat AS patients with end-stage hip involvement, and previous literature has also demonstrated the encouraging outcomes of cementless or cement implant reconstruction.[4,5] In our series, the CROs and the PROs of the 56 female patients have been entirely improved at the latest follow-up visit compared with pre-operative baseline data [Supplementary Table 2, http://links.lww.com/CM9/A780]. However, when comparing female and male AS patients who had undergone THA, no significant difference was discovered in any clinical parameter, including BASDAI, BASFI, HHS, SF-12 MCS, SF-12 PCS, and patients' satisfaction. These results indicate that the female gender seems not to be prone to poor outcomes after THA reconstruction.

There are some limitations to this study. First, the study was retrospective and had the inherent possibility of inaccurate medical records and information bias. Second, all THAs were performed by several surgeons. Considering the extended duration of follow-up, the surgical technique has changed a lot, especially in the surgical approach and implant design. All these could lead to a diversity of implant selections and surgical techniques inevitably. Third, it lacked long-term follow-up data which could support the conclusions effectively.

Despite these limitations, this is the largest study evaluating the impact of gender on baseline demographics, clinical, and laboratory parameters, and the outcomes of THAs performed on female patients with AS. Although in our series, there were significant differences between female and male AS patients with regard to baseline demographics and clinical and laboratory parameters, the clinical results of THAs on female patients were similar to those on male patients. These findings may provide more information for surgeons to communicate with patients, and to further study the gender differences in the surgical treatment, so as to optimize the perioperative management strategy.

Conflicts of interest

None.

References

1. Rusman T, van Vollenhoven RF, van der Horst-Bruinsma IE. Gender differences in axial spondylarthritis: women are not so lucky. Curr Rheumatol Rep 2018;20:35. doi: 10.1007/s11926-018-0744-2.
2. Rocha FAC, Pinto ACMD, Lopes JR, Deodhar A. Tumor necrosis factor inhibitors prevent structural damage in hips in ankylosing spondylitis-time to reconsider treatment guidelines? A case series and review of literature. Clin Rheumatol 2021;40:1881–1887. doi: 10.1007/s10067-020-05519-0.
3. Huang F, Sun F, Wan WG, Wu LJ, Dong LL, Zhang X, *et al*. Secukinumab provided significant and sustained improvement in the signs and symptoms of ankylosing spondylitis: results from the 52-week, phase III China-centric study, MEASURE 5. Chin Med J 2020;133:2521–2531. doi: 10.1097/CM9.0000000000001099.
4. Zhang L, Yang D, Yin X, Zhou Y. Risk factors for poor hip flexion after total hip arthroplasty for the treatment of ankylosing spondylitis a multivariate analysis. Clin Rheumatol 2014;33:1295–1301. doi: 10.1007/s10067-014-2575-5.
5. Gautam D, Malhotra R. Total hip arthroplasty in ankylosing spondylitis with extension contracture of hips. J Arthroplasty 2019;34:71–76. doi: 10.1016/j.arth.2018.08.025.

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